Drug and Alcohol Dependence 163 (2016) 71–76

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Full length article

Post-quit stress mediates the relation between social support and smoking cessation among socioeconomically disadvantaged adults

Frank C. Bandiera[a,b,*], Folefac Atem[a], Ping Ma[c], Michael S. Businelle[d,e], Darla E. Kendzor[d,e]

[a] University of Texas, School of Public Health, Dallas Regional Campus, United States
[b] The University of Texas, Southwestern Medical Center, Harold C. Simmons Comprehensive Cancer Center, United States
[c] The University of Texas, Southwestern Medical Center, United States
[d] University of Oklahoma, Health Sciences Center, United States
[e] Stephenson Cancer Center, United States

ARTICLE INFO

Article history:
Received 9 December 2015
Received in revised form 23 March 2016
Accepted 27 March 2016
Available online 1 April 2016

Keywords:
Social support
Stress
Smoking cessation
Socioeconomically disadvantaged adults

ABSTRACT

Objective: Social support interventions have demonstrated limited effectiveness for preventing smoking relapse. The stress-buffering hypothesis may be a useful framework by which to understand social support in smoking cessation interventions. The current study evaluated the interrelations among social support, stress, and smoking cessation in both moderation and mediation models.

Methods: Participants ($N = 139$) were enrolled in a smoking cessation study at the safety-net hospital in Dallas, Texas. During the week prior to a scheduled quit attempt, general social support was measured using the Interpersonal Support Evaluation List (ISEL) questionnaire and smoking-specific social support was measured via repeated smartphone-based ecological momentary assessments (EMA). Post-quit stress was repeatedly assessed via smartphone. Logistic regression analyses evaluated potential interaction effects of pre-quit social support and post-quit stress on the likelihood of achieving biochemically-verified 7-day point prevalence abstinence at 4 weeks post-quit. Mediation models were evaluated to determine if post-quit stress mediated the association between pre-quit social support and smoking cessation.

Results: Participants were predominantly Black (63.3%) and female (57.6%); and 55% reported an annual household income of <$12,000. Analyses indicated that pre-quit social support did not significantly interact with post-quit stress to influence smoking cessation. However, post-quit stress did mediate associations between social support variables and smoking cessation.

Conclusions: Findings indicated that social support impacts smoking cessation through its influence on post-quit stress among socioeconomically disadvantaged adults participating in cessation treatment. Increasing social support for the specific purpose of reducing stress during a quit attempt may improve smoking cessation rates in disadvantaged populations.

1. Introduction

Although public health efforts have resulted in dramatic decreases in smoking prevalence, smoking remains the leading preventable cause of death in the U.S. (US Department Health and Human Services, 2014). Individuals of lower socioeconomic status have substantially higher rates of smoking (Centers for Disease Control and Prevention, 2014), are more dependent on cigarettes, and have a harder time quitting smoking than individuals of higher socioeconomic status (Businelle et al., 2010; Fernandez et al., 2006; Kendzor et al., 2012; Wetter et al., 2005). Notably, socioeconomic disadvantage is also associated with lower social support (Campbell et al., 1986; Cohen et al., 1999; John-Henderson et al., 2015; Murray et al., 1995) and having less social support is associated with a reduced likelihood of smoking cessation (Hanson et al., 1990; Lawhon et al., 2009; Mermelstein et al., 1986; Murray et al., 1995). Surprisingly, interventions that have aimed to increase social support have had limited success (Tsoh et al., 2015) at increasing smoking cessation (Hogan et al., 2002; May and West, 2000). One explanation for this might be the absence of a theoretical framework to guide the manner in which support is delivered and utilized during a cessation attempt (see Hogan et al., 2002; May and West, 2000; Westmaas et al., 2010).

* Corresponding author at: University of Texas School of Public Health, Dallas campus, 6011 Harry Hines Blvd., V8.112, Dallas, TX 75390-9128, Unites States.
E-mail address: Frank.Bandiera@UTSouthwestern.edu (F.C. Bandiera).

http://dx.doi.org/10.1016/j.drugalcdep.2016.03.023

The Stress-Buffering Hypothesis (Cohen and Wills, 1985) posits that social support may buffer against the adverse impact of perceived stress on health. Cohen and Wills (1985) discussed the potential for both interactions and main effects of social support on health. In their main effect model, persons with low social support may have higher levels of perceived stress and poor health outcomes, while persons with high social support may have lower levels of perceived stress and more positive health outcomes. In the interaction model, the effect of stress on health depends on the level of perceived social support. Specifically, in those with low levels of social support, stress may have greater negative impacts on health, whereas in those with high levels of social support, the effect of stress on health may be attenuated. This conceptual framework may be useful for understanding how social support might influence perceived stress during a quit attempt, and ultimately how social support may impact smoking cessation. Indeed, Creswell et al. (2015) recently showed that greater social support was associated with reduced relapse risk among weight-concerned women, and that this relationship was mediated by reductions in withdrawal symptoms (but not depression) over time. Continued research is needed to understand the influence of social support on smoking cessation across populations, and to determine the role of stress specifically.

Research has shown that individuals of low socioeconomic status (SES) experience more stressors than higher SES adults (Hatch and Dohrenwend, 2007; Lantz et al., 2005; Mcleod and Kessler, 1990), and numerous studies have indicated that perceived stress is related to smoking relapse (Cohen and Lichtenstein, 1990; Kassel et al., 2003; Siahpush and Carlin, 2006). For example, perceived stress (Cohen and Lichtenstein, 1990), financial stress (Kendzor et al., 2010; Siahpush and Carlin, 2006), and physiological indicators of stress (Al'absi, 2006) have each been shown to predict smoking relapse. In fact, many individuals attribute their relapse, at least in part, to perceived stress (Shiffman, 1982).

In summary, little attention has been paid to the stress-buffering hypothesis in relation to smoking cessation outcomes. The purpose of the current study was to test the potential stress buffering effects of several aspects of social support on smoking cessation in a socioeconomically disadvantaged, and primarily African American, safety-net hospital sample. Moderation and mediation analyses were conducted to evaluate the interrelations among social support, perceived stress, and smoking cessation among individuals making a quit attempt. Specifically, we hypothesized that the association between stress and smoking cessation would be attenuated with high social support levels, while the association between stress and smoking cessation would be stronger under lower levels of social support. We additionally hypothesized that stress would mediate the association between social support and smoking cessation, such that greater social support would lead to lower perceived stress and thereby increase the likelihood of smoking cessation. Findings will inform the development and adaptation of smoking cessation interventions for socioeconomically disadvantaged smokers.

2. Methods

2.1. Procedure

A total of 222 potential participants were approached regarding their interest in participating in a smoking cessation intervention study at the orientation session of a safety net hospital smoking cessation program between August, 2011 and April, 2013. Of those screened, 69 did not meet inclusion criteria, 7 were enrolled but did not return after the baseline visit, and 7 did not have complete data for the current study analyses, leaving an analytic sample of 139 participants (For more information about the parent study see Kendzor et al., 2015). Informed consent was obtained from interested individuals, and they were screened for eligibility on-site either while they were waiting to be seen by the physician or after their physician appointment. Individual screening took place in a private room in the clinic. Participant eligibility for the current study did not influence eligibility for the hospital smoking cessation program. The *Rapid Estimate of Adult Literacy in Medicine* (REALM; Davis et al., 1993) was administered to ensure that all participants were able to read at > sixth grade level (i.e., required to complete EMA and self-report questionnaires). Expired carbon monoxide (CO) was measured to verify smoking status. Additional inclusion criteria were: 1) age ≥18 years, 2) smoking ≥5 cigarettes per day, 3) willing to quit smoking within 7 days of enrollment, and 4) willingness/ability to attend 6 sessions. All participants were asked to complete in-person weekly assessments from 1 week pre-quit through 4 weeks post-quit. Participants completed self-report questionnaires on a laptop computer; and expired CO, weight, and height were measured in a private room to ensure confidentiality. Participants were provided with an LG Optimus Android smartphone for ecological momentary assessments (EMAs) and instructed on the use of the phone. Participants were asked to complete smartphone assessments 5 times daily (1 daily diary each morning, 4 random assessments per day) from 1 week pre-quit through 1 week post-quit. Participants were instructed to quit smoking at bedtime or 10:00 pm (whichever occurred first), on the evening prior to their second scheduled weekly session of the Parkland smoking cessation program.

2.2. Intervention

2.2.1. Usual care. Safety net hospital patients were offered all recommended components of an intensive tobacco treatment intervention (Fiore et al., 2008). Participants attended an initial clinic orientation and educational session, followed by weekly group support sessions facilitated by social workers. Participants were seen by a physician or other prescribing healthcare professional on a weekly or as needed basis to receive pharmacotherapy.

2.2.2. Usual care plus financial incentives for smoking abstinence. Participants had the opportunity to earn small weekly incentives in the form of gift cards, if they (1) self-reported abstinence during the past 12 h on the quit day, or self-reported abstinence during the past 7 days at each weekly visit from 1 week through 4 weeks after the quit date; and (2) provided an expired CO sample consistent with abstinence. Participants earned a $20 gift card to a popular retail chain in exchange for biochemically confirmed abstinence on the quit date. An escalating schedule was employed, such that the amount of the incentives increased by $5 with each weekly successive abstinent visit through 4 weeks after the quit date. Participants who were non-abstinent at any visit were eligible to earn incentives for abstinence at the next visit, although the amount was reset to $20.

2.3. Measures

2.3.1. Sociodemographic variables. Several sociodemographic variables were assessed including age, gender, race/ethnicity, education, years of smoking, and cigarettes smoked per day at baseline. Note that race/ethnicity was dichotomized into non-Hispanic White and Black/other racial/ethnic minority because the vast majority of participants were either non-Hispanic White or Black.

2.3.2. Social support. General social support over the past week was measured on the quit date using the Interpersonal Support Evaluation List (ISEL). The ISEL is a 12-item self-report measure of the

perceived availability of social support, which contains three subscales (ISEL-12; Cohen and Hoberman, 1983). The Tangible Support subscale measures the perceived availability of material aid (e.g., able to borrow money if needed), the Belonging subscale measures the perceived availability of others' with whom one may engage in activities, and the Appraisal subscale measures the perceived availability of others with whom one can talk about problems. Items are rated on a four-point scale, and scores range from 4 to 16 on each subscale. Higher scores indicate greater social support. We considered each support subscale separately and also all types combined for a total score.

2.3.3. Smoking specific social support. Smoking specific social support was assessed via smartphone-based daily diary EMA prompts during the 7 days prior to the quit day by asking participants to respond (i.e., 5 point scale ranging from strongly disagree to strongly agree) to this statement: "My friends and family supported me in my attempt to quit smoking yesterday." The smoking-specific social support variable was highly reliable across the 7 day pre-quit period (ICC = 0.89) and was significantly correlated with ISEL total score ($r = 0.418$; $p < 0.001$).

2.3.4. Stress. Current stress was assessed via EMA prompts (5 times per day) during the 7 days following the quit day with one item: "I feel stressed." Participants responded on a 5 point scale that ranged from strongly disagree to strongly agree.

2.3.5. Smoking cessation. According to the Society of Research on Nicotine and Tobacco Subcommittee on Biochemical Verification (SRNT Subcommittee on Biochemical Verification, 2002), carbon monoxide (CO) levels of 8–10 parts per million or greater suggest recent cigarette smoking with a sensitivity and specificity of approximately 90%. Thus, we defined abstinence at the 4 week post-quit visit as a self-report of smoking abstinence over the previous 7 days in combination with an expired CO level of less than 8 parts per million.

2.4. Statistical analyses

Logistic regression models were used to examine relationships between social support and smoking status, controlling for baseline treatment group assignment, education, average number of cigarettes smoked per day, medication type, race (White versus Black/other) and gender. Correlations between social support, perceived stress, and smoking status were evaluated. The potential indirect effects of social support on smoking status via perceived stress were examined using the Preacher and Hayes INDIRECT macro for SPSS (Hayes, 2015; Preacher and Hayes, 2008). Five models were tested. In each model, EMA-measured stress was averaged for each individual (measured via EMA up to 5 times per day for the first 7 days of the quit attempt) and entered as the mediator variable, and CO confirmed 7-day point prevalence abstinence at 4 weeks post-quit was entered as the dependent variable. The ISEL total score and each of the 3 subscale scores were entered as independent variables in Models 1–4, respectively. The smoking specific EMA social support item (i.e., my family and friends supported me in my attempt to quit smoking yesterday) was averaged across pre-quit daily diary assessments and included as the independent variable for Model 5. Finally, we examined how interactions between each social support type and stress impacted smoking status at the 4 week post-quit visit.

3. Results

3.1. Descriptive statistics

Participants ($N = 139$) were primarily female (57.6%) and most participants were Non-Hispanic African American (63.3%) or Non-Hispanic White (27.3%). Participant characteristics are detailed in Table 1.

3.2. Correlations among main variables

Total social support, $r = -0.21$, $p = 0.013$, belonging support, $r = -0.22$, $p = 0.008$, and appraisal support, $r = -0.20$, $p = 0.016$, were negatively correlated with smoking cessation. Tangible support, $r = -0.14$, $p = 0.102$, and smoking specific support from friends and family, $r = -0.01$, $p = 0.920$, were not significant related with smoking cessation. Perceived stress, $r = 0.26$, $p = 0.012$, was positively correlated with smoking cessation. Total social support, $r = -0.40$, $p < 0.001$, appraisal support, $r = -0.32$, $p < 0.001$, belonging support, $r = -0.43$, $p < 0.001$, tangible support, $r = -0.30$, $p = 0.001$, and smoking specific support from friends and family, $r = -0.22$, $p = 0.009$, were negatively correlated with perceived stress.

3.3. Mediation and moderation

Five logistic regression models with 1000 bootstrap samples were used to examine the relationships between social support and abstinence status at the 4-week follow-up visit, controlling for group assignment, education, average number of cigarettes smoked per day, medication type, race, and gender. After controlling for covariates, all models indicated a significant and negative relationship between the independent variables (i.e., Total ISEL, ISEL Appraisal subscale score, ISEL Belonging subscale score, ISEL Tangible subscale score and EMA measured support from friends and family) and the mediator (EMA stress). Furthermore, in all models the mediator was positively associated with cessation. After controlling for covariates and considering the total effects of the independent variables on cessation, only the ISEL belonging scale was negatively associated with cessation, while all other models were non-significant (Table 2). INDIRECT macro results indicated that higher levels of social support indirectly reduced the likelihood of smoking relapse through reductions in perceived stress in all models. That is, greater Total ISEL, ISEL Appraisal subscale score, ISEL Belonging subscale score, ISEL Tangible subscale score, and pre-quit EMA assessed cessation support from friends and family led to lower levels of post-quit EMA-measured stress which increased the likelihood of smoking abstinence at the 4 week post-quit follow-up visit (Table 2). Analyses were conducted to determine if social support moderated the impact of perceived stress on smoking cessation. Results indicated that none of the interactions between social support and stress predicted smoking status at the 4 week follow-up visit, all p's > 0.05.

4. Discussion

The purpose of the current study was to evaluate the interrelations among several dimensions of social support, perceived stress, and smoking cessation among socioeconomically disadvantaged smokers making a quit attempt. Notably, Creswell et al. (2015) recently reported that greater social support was associated with reduced relapse risk due to reductions in withdrawal symptoms among weight-concerned women. The current findings extend previous research by showing that lower social support was associated with a reduced likelihood of smoking cessation 4 weeks after a quit attempt due to greater perceived stress during the first week post-quit. In addition, the current study extends previous

Table 1
Participant characteristics (N = 139).

	Mean (SD)	N (%)
Age	52.47 (7.03)	
Years of smoking	31.86 (8.87)	
Cigarette smoked per day	17.43 (8.70)	
Race:		
White		38 (27.34)
Non-white		101 (72.66)
Gender:		
Male		59 (42.45)
Female		80 (57.55)
Education (years)	12.01 (2.04)	
Total ISEL	36.52 (7.89)	
BL ISEL Appraisal sub scale score	12.41 (2.88)	
BL ISEL Belonging sub scale score	11.87 (3.15)	
BL ISEL Tangible sub scale score	12.23 (2.82)	
My friends and family supported me in my attempt to quit smoking yesterday	3.99 (0.80)	
Post-quit EMA average—"I feel stressed"	2.53 (1.12)	
7 day point prevalence abstinence at week 4		
No = 0		84 (60.43)
Yes = 1		55 (39.57)
Medication type:		
Nicotine patch		71 (51.08)
Chantix		49 (35.25)
Other medications		19 (13.67)

Table 2
Total and direct effects of social support and EMA stress on smoking cessation.

Model	IV to Mediator Estimate (p)	Mediator to DV Estimate (p)	Total effect of IV to DV Estimate (p)	Direct Effect of IV on DV Estimate (p)	Effect (Bias corrected C.I.)
Total ISEL	−0.1481 (0.0000)	0.4659 (0.0223)	−0.1311 (0.0726)	−0.0699 (0.3752)	−0.0690 (−0.1510, −0.0085)
ISEL Appraisal	−0.1156 (0.0003)	0.4651 (0.0203)	0.1260 (0.0672)	−0.0808 (0.2548)	−0.0537 (−0.1310, −0.0065)
ISEL Belonging	−0.1400 (0.0000)	0.4347 (0.0349)	−0.1396 (0.0306)	−0.0857 (0.2210)	−0.0609 (−0.1281, −0.0014)
ISEL Tangible	−0.0979 (0.0028)	0.5254 (0.0086)	−0.0499 (0.4488)	0.0007 (0.9920)	−0.0515 (−0.1318, −0.0065)
Smoking-specific support	−0.3104 (0.0086)	0.4517 (0.0178)	−0.1922 (0.4178)	−0.0483 (0.8486)	−0.1402 (−0.3617, −0.0071)

research by evaluating the stress-buffering hypothesis in a sample of socioeconomically disadvantaged and predominantly African American men and women and by using real-time ecologically valid assessments of both smoking-specific social support (pre-quit) and stress (post-quit). Findings suggest that individuals with low levels of social support might benefit from interventions designed to increase or improve social support for the specific purpose of managing stress during a quit attempt.

Study findings have implications for behavioral interventions. Interventions that focus on increasing social support, especially among those with low social support, may have a positive impact on the likelihood of cessation. In general, interventions might focus on improving the quality of support within existing networks by providing guidance about effective support strategies. Individuals participating in treatment as well as key supports may be educated about how social support can be used to attenuate stress, and those in treatment can be advised to seek out social support during times of stress. Novel strategies to increase and improve the quality of social support may include family focused interventions (Tsoh et al., 2015) and social media support forums (Cheung et al., 2015; Pechmann et al., 2015). Religious attendance has been linked with smoking cessation (Strawbridge et al., 2001), suggesting the possibility that religious social networks could be used to increase support for cessation.

Notably, social support may represent a psychosocial resource of particular importance in socioeconomically disadvantaged populations. In conceptual models of socioeconomic status and health, having fewer intrapersonal resources, including social support, is linked to poor health outcomes partially due to increased stress and negative affect (Matthews and Gallo, 2011; Matthews et al., 2010). Socioeconomically disadvantaged individuals experience greater exposure to stress and negative life events relative to individuals of higher socioeconomic status (Hatch and Dohrenwend, 2007; Lantz et al., 2005; Mcleod and Kessler, 1990), and may plausibly experience a greater protective benefit from social support when experiencing additional cessation-related stress. Thus, interventions that aim to boost social support to facilitate coping with cessation-related stress may result in improved smoking cessation outcomes in socioeconomically disadvantaged populations.

4.1. Strengths and limitations

The current study has a number of strengths and limitations. The sample was relatively small, though the study was adequately powered to detect mediation effects. Study participants were recruited from a local smoking cessation clinic, and therefore findings may be less applicable to the general population of socioeconomically disadvantaged smokers. In addition, the current study had a narrow focus on stress, though other factors, such as depression and anxiety, may also play a role in the relation between social support and cessation. A strength of this study is that a smartphone-based EMA approach was used to measure stress and cessation related social support. Real-time data collection is likely to more accurately reflect stress levels than clinic-based retrospective recall (Shiffman, 2009; Stone et al., 2002). Further, a well validated multidimensional measure of social support was used (i.e., the ISEL), in addition to an EMA measure of smoking-specific support from friends and family. Finally, the current study focused specifically on a socioeconomically disadvantaged safety net hospital population for whom

social support may play a particularly important role in smoking cessation.

4.2. Conclusions and future directions

In summary, this study tested the stress-buffering hypothesis among socioeconomically disadvantaged individuals making a smoking cessation attempt. Findings indicated that perceived stress mediated the association between social support and smoking cessation. Thus, social support may play a key role in attenuating perceived stress during the early post-quit period and thereby influence the likelihood of smoking cessation following a quit attempt. Findings may suggest that interventions that focus social support on reducing stress in socioeconomically disadvantaged populations may increase cessation rates. Notably, all forms of social support measured in the current study indirectly influenced smoking cessation through an influence on perceived stress. Future research should evaluate the impact of increasing social support and utilizing existing social support networks to help individuals attenuate post-quit stress during planned smoking cessation attempts.

Role of funding source

Funding for this research was provided by the University of Texas Health Science Center, School of Public Health. Data analysis and manuscript preparation were supported by American Cancer Society grants MRSGT-10-104-01-CPHPS (to DEK) and MRSGT-12-114-01-CPPB (to MSB). Additional programming and technological support was provided through the e-Health Technology Program, a resource of the National Institutes of Health through the MD Anderson Cancer Center Support Grant (CA016672) and the Duncan Family Institute for Cancer Prevention and Risk Assessment.

Contributors

Frank Bandiera conceived of the study and wrote an initial draft of the manuscript. Michael Businelle and Folefac Atem conducted the statistical analyses. Michael Businelle, Folefac Atem, Ping Ma, and Darla Kendzor reviewed versions of the manuscript.

Conflict of interest

The authors declare that there are no conflicts of interest.

References

Al'absi, M., 2006. Hypothalamic-pituitary-adrenocortical responses to psychological stress and risk for smoking relapse. Int. J. Psychophysiol. 59, 218–227.

Businelle, M.S., Kendzor, D.E., Reitzel, L.R., Costello, T.J., Cofta-Woerpel, L., Li, Y., Mazas, C.A., Vidrine, J.I., Cinciripini, P.M., Greisinger, A.J., Wetter, D.W., 2010. Mechanisms linking socioeconomic status to smoking cessation: a structural equation modeling approach. Health Psychol. 29, 262–273.

Campbell, K.E., Marsden, P.V., Hurlbert, J.S., 1986. Social resources and socioeconomic status. Soc. Netw. 8, 97–117.

Centers for Disease Control and Prevention, 2012. Current cigarette smoking among adults—United States, 2005–2012. MMWR 63, 29–34.

Cheung, Y.T., Can, C.H., Lai, C.K., Chan, W.F., Wang, M.P., Li, H.C., Chan, S.S., Lam, T.H., 2015. Using whatsapp and facebook online social groups for smoking relapse prevention for recent quitters: a pilot pragmatic cluster randomized controlled trial. J. Med. Internet Res. 17, E238.

Cohen, S., Hoberman, H.M., 1983. Positive events and social supports as buffers of life change stress. J. Appl. Soc. Psychol. 13, 99–125.

Cohen, S., Lichtenstein, E., 1990. Perceived stress quitting smoking and smoking relapse. Health Psychol. 9, 466–478.

Cohen, S., Wills, T.A., 1985. Stress social support and the buffering hypothesis. Psychol. Bull. 98, 310–357.

Cohen, S., Kaplan, G.A., Salonen, J.T., 1999. The role of psychological characteristics in the relation between socioeconomic status and perceived health. J. Appl. Soc. Psychol. 29, 445–468.

Creswell, K.G., Cheng, Y., Levine, M.D., 2015. A test of the stress-buffering model of social support in smoking cessation: is the relationship between social support and time to relapse mediated by reduced withdrawal symptoms? Nicotine Tob. Res. 17, 566–571.

Davis, T.C., Long, S.W., Jackson, R.H., Mayeaux, E.J., George, R.B., Murphy, P.W., Crouch, M.A., 1993. Rapid estimate of adult literacy In medicine: a shortened screening instrument. Fam. Med. 25, 391–395.

Fernandez, E., Schiaffino, A., Borrell, C., Benach, J., Ariza, C., Ramon, J.M., Twose, J., Nebot, M., Kunst, A., 2006. Social class, education, and smoking cessation: long-term follow-up of patients treated at a smoking cessation unit. Nicotine Tob. Res. 8, 29–36.

Fiore, M.C., Jaen, C.R., Baker, T.B., Bailey, W.C., Benowitz, N.L., Curry, S.J., Dorfman, S.F., Froelicher, E.S., 2008. Treating Tobacco Use and Dependence: 2008 Update. Clinical Practice Guideline. Department of Health and Human Services. Public Health Service, Rockville, MD.

Hanson, B.S., Isacsson, S.O., Janzon, L., Lindell, S.E., 1990. Social support and quitting smoking for good. is there an association? Results from the population study, "men born In 1914," Malmo Sweden. Addict. Behav. 15, 221–233.

Hatch, S.L., Dohrenwend, B.P., 2007. Distribution of traumatic and other stressful life events by race/ethnicity, gender, ses and age: a review of the research. Am. J. Community Psychol. 40, 313–332.

Hayes, A.F., 2015. My Macros and Code for SPSS and SAS (accessed 11.17.15.). http://afhayes.com/spss-sas-and-mplus-macros-and-code.html.

Hogan, B.E., Linden, W., Najarian, B., 2002. Social support interventions: do they work? Clin. Psychol. Rev. 22, 383–442.

John-Henderson, N.A., Stellar, J.E., Mendoza-Denton, R., Francis, D.D., 2015. Socioeconomic status and social support: social support reduces inflammatory reactivity for individuals whose early-life socioeconomic status was low. Psychol. Sci. 26, 1620–1629.

Kassel, J.D., Stroud, L.R., Paronis, C.A., 2003. Smoking, stress, and negative affect correlation, causation and context across stages of smoking. Psychol. Bull. 129, 270–304.

Kendzor, D.E., Businelle, M.S., Costello, T.J., Castro, Y., Reitzel, L.R., Cofta-Woerpel, L.M., Li, Y., Mazas, C.A., Vidrine, J.I., Cinciripini, P.M., Greisinger, A.J., Wetter, D.W., 2010. Financial strain and smoking cessation among racially/ethnically diverse smokers. Am. J. Public Health 100, 702–706.

Kendzor, D.E., Reitzel, L.R., Mazas, C.A., Cofta-Woerpel, L.M., Cao, Y., Ji, L., Costello, T.J., Vidrine, J.I., Businelle, M.S., Li, Y., Castro, Y., Ahluwalia, J.S., Cinciripini, P.M., Wetter, D.W., 2012. Individual- and area-level unemployment influence smoking cessation among African Americans participating In a randomized clinical trial. Soc. Sci. Med. 74, 1394–1401.

Kendzor, D.E., Businelle, M.S., Poonawalla, I.B., Cuate, E.L., Kesh, A., Rios, D.M., Ma, P., Balis, D.S., 2015. Financial incentives for abstinence among socioeconomically disadvantaged individuals in smoking cessation treatment. Am. J. Public Health 105, 1198–1205.

Lantz, P.M., House, J.S., Mero, R.P., Williams, D.R., 2005. Stress, life events, and socioeconomic disparities in health: results from the americans' changing lives study. J. Health Soc. Behav. 46, 274–288.

Lawhon, D., Humfleet, G.L., Hall, S.M., Reus, V.I., Muñoz, R.F., 2009. Longitudinal analysis of abstinence-specific social support and smoking cessation. Health Psychol. 28, 465–472.

Matthews, K.A., Gallo, L.C., 2011. Psychological perspectives on pathways linking socioeconomic status and physical health. Annu. Rev. Psychol. 62, 501–530.

Matthews, K.A., Gallo, L.C., Taylor, S.E., 2010. Are psychosocial factors mediators of socioeconomic status and health connections? Ann. N.Y. Acad. Sci. 1186, 146–173.

May, S., West, R., 2000. Do social support interventions ("Buddy systems") aid smoking cessation? A review. Tob. Control 9, 415–422.

Mcleod, J.D., Kessler, R.C., 1990. Socioeconomic status differences In vulnerability to undesirable life events. J. Health Soc. Behav. 31, 162–172.

Mermelstein, R., Cohen, S., Lichtenstein, E., Baer, J.S., Kamarck, T., 1986. Social support and smoking cessation and maintenance. J. Consult. Clin. Psychol. 54, 447–453.

Murray, R.P., Johnston, J.J., Dolce, J.J., Lee, W.W., O'hara, P., 1995. Social support for smoking cessation and abstinence: the lung health study lung health study research group. Addict. Behav. 20, 159–170.

Pechmann, C., Pan, L., Delucchi, K., Lakon, C.M., Prochaska, J.J., 2015. Development of a twitter-based intervention for smoking cessation that encourages high-quality social media interactions via automessages. J. Med. Internet Res. 17, E50.

Preacher, K.J., Hayes, A.F., 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav. Res. Methods 40, 879–891.

SRNT Subcommittee on Biochemical Verification, 2002. Biochemical verification of tobacco use and cessation. Nicotine Tob. Res. 4, 149–159.

Shiffman, S., 1982. Relapse following smoking cessation: a situational analysis. J. Consult. Clin. Psychol. 50, 71–86.

Shiffman, S., 2009. Ecological momentary assessment (EMA) In studies of substance use. Psychol. Assess. 21, 486–497.

Siahpush, M., Carlin, J.B., 2006. Financial stress, smoking cessation and relapse: results from a prospective study of an Australian national sample. Addiction 101, 121–127.

Stone, A.A., Shiffman, S., Schwartz, J.E., Broderick, J.E., Hufford, M.R., 2002. Patient non-compliance with paper diaries. BMJ 324, 1193–1194.

Strawbridge, W.J., Shema, S.J., Cohen, R.D., Kaplan, G.A., 2001. Religious attendance increases survival by improving and maintaining good health behaviors mental health and social relationships. Ann. Behav. Med. 23, 68–74.
Tsoh, J.Y., Burke, N.J., Gildengorin, G., Wong, C., Le, K., Nguyen, A., Chan, J.L., Sun, A., Mcphee, S.J., Nguyen, T.T., 2015. A social network family-focused intervention to promote smoking cessation in Chinese and Vietnamese american male smokers: a feasibility study. Nicotine Tob. Res. 17, 1029–1038.
US Department Health and Human Services, 2014. The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General, 2014 (accessed 12.10.14.). http://www.surgeongeneral.gov/library/reports/50-years-of-progress/.
Westmaas, J.L., Bontemps-Jones, J., Bauer, J.E., 2010. Social support in smoking cessation: reconciling theory and evidence. Nicotine Tob. Res. 12, 695–707.
Wetter, D.W., Cofta-Gunn, L., Irvin, J.E., Fouladi, R.T., Wright, K., Daza, P., Mazas, C., Cinciripini, P.M., Gritz, E.R., 2005. What accounts for the association of education and smoking cessation? Prev. Med. 40, 452–460.